Name _____ AP Chemistry

Atomic Spectroscopy Lab

Introduction

A number of metallic elements from Groups 1A and 2A have especially bright emission lines in the visible light region. The emissions are so strong and characteristically colored that these elements can often be recognized by the gross color they impart when aspirated into a burner flame, even without the use of a spectroscope. For example, lithium ions impart a red color to a burner flame, sodium ions a yellow/orange color, potassium ions a violet color, calcium ions a brick red color, strontium a brighter red color, and barium ions a green color. In this activity you will excite the ions of each of the elements listed above, using a Bunsen burner. You will observe the gross color imparted to the flame to assist you in determining what elements are present in the unknown mixture.

Prelab Questions

1) Based on the colors described in the introduction, what wavelengths do you expect each ion to be excited at?

Procedure

1) Obtain a Nichrome wire loop and a well plate.
2) Place a small amount of each of the solutions in a well on the well plate.
3) Obtain a small amount of 6 M HCl in a beaker.
4) Light a Bunsen burner. Place the Nichrome wire loop in the 6 M HCl and then place it into the flame. Continue to heat the wire until its red-hot.
5) Once the wire loop is clean, place the wire loop into a solution. Then place the wire loop into the flame.
6) Record the color that you observe.
7) Clean the wire loop again using the 6 M HCl.
8) Repeat the process for the remaining metals along with the unknown.

Data/Results

Metal Ion	Color Observed
Li^+	
Na^+	
K^+	
Ca^{2+}	

Sr^{2+}	
Ba^{2+}	
Unknown	

Using the following website (http://chemlinks.beloit.edu/BlueLight/moviepages/em_el.htm), draw the line spectra for the above metals.

Postlab Questions

1) What was the identity of the unknown mixture? How were you able to tell this?
2) How did the gross colors imparted to the flame by the metal ion solutions compare with the individual spectral lines you drew? What wavelengths on the line spectra do you match up with the colors you observed in the flame?
3) Of the metal cations tested, sodium usually gives the brightest and most persistent color to the frame. What problem would this introduce if a real mixture containing both sodium and other cations were to be analyzed by the technique used in this experiment? How could be these problems be solved?
4) Atomic spectroscopy is used in police laboratories for the identification of samples collected at crime scenes—bullet fragments, for example. A bullet typically might consist of an alloy of several metals (copper, zinc, lead, etc.). How would you expect the atomic spectrum of a mixture of elements to compare to the individual spectra of the constituent elements in the sample? Would you expect the spectrum of a mixture to be superimposition of the individual spectra, or would you expect the spectral emissions of one atom to influence the spectrum of another atom?

*Adapted from "Atomic Spectroscopy"—Hall, J.F.; *Experimental Chemistry (7th Edition)*, 2007, p. 199-216.